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ABSTRACT

A general inventory and initial assessment of marine education activities in California elementary and secondary public schools based on data collected in 1980 are presented. The report includes: (1) a description of the procedures and findings of a series of surveys and questionnaires distributed to schools, individuals, and organizations; and (2) a set of conclusions derived from the findings. Section one briefly describes the history of Sea Grant and the objectives of the project. The second section sets forth the procedures employed in data acquisition. The third section presents the tabulated data concerning elementary and secondary school marine education expressed in terms of instructors, courses, instructional materials, and resources. The final section summarizes an analysis of the data and presents some recommendations received from junior high and high school educators about improving marine education in California public schools. Findings indicate a general lack of awareness, staff, courses and textbooks for marine education. (Author/DC)

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Summary Report of
Marine Education in California Public Schools
Kindergarten through Twelfth Grade

by
Kay Thornley

Science Writing Program
University of California, Santa Cruz

A California Sea Grant College Program Publication

Report #T-CSGCP-002

SEA GRANT
CALIFORNIA

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Summary Report of Marine Education in California Public Schools

Kindergarten through Twelfth Grade

By

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Science Writer Intern
University of California, Santa Cruz

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TABLE OF CONTENTS

INTRODUCTION v

SECTION ONE: BACKGROUND 1

SECTION TWO: RESEARCH STRATEGIES 1

SECTION THREE: FINDINGS 3

I. Identification of specific instructors 3
II. Identification of courses and enrollments 5
III. Identification of instructional materials 11
IV. Identification of marine education resources 18

SECTION FOUR: CONCLUSIONS 22

APPENDIX A: National Survey (Office of Sea Grant) 25

APPENDIX B: California State Survey Summary 27

INTRODUCTION

In recent years, human dependence on marine resources has increased dramatically. With 50 percent of the global population living within fifty miles of the oceans, human activity has led to significant degradation of both coastal and deepwater systems. In California, public knowledge about the marine environment is particularly critical because of the extensive coastline (1845 miles) and the multitude of people living in coastal counties (17.6 million people, or 80 percent of the state's population). Hence, education about the marine environment is necessary and appropriate at all levels. The nature and scope of this education, however, is largely undocumented, particularly in elementary and secondary schools.

This report, prepared through an undergraduate science writing internship program at the University of California, Santa Cruz, was supported by the California Sea Grant College Program. It provides a general inventory and initial assessment of marine education activities in California elementary and secondary public schools based on data collected in 1980. Specifically, the report includes (1) a description of the procedures and findings of a series of surveys and questionnaires distributed to schools, individuals, and organizations, and (2) a set of conclusions derived from the findings.

The report is organized into four sections. Section one briefly describes the history of Sea Grant and the objectives of the project. The second section sets forth the procedures employed in data acquisition. The third section presents the tabulated data concerning elementary and secondary school marine education expressed in terms of instructors, courses, instructional materials, and resources. The final section summarizes an analysis of the data and presents some recommendations received from junior high and high school educators about improving marine education in California public schools.

A more detailed report for internal use by Sea Grant includes a complete compilation of all materials used in preparing this summary report. In addition, Sea Grant maintains files of information and resource materials acquired in the study, including addresses of organizations and individuals, program descriptions, and samples of marine education materials used throughout the state.

James J. Sullivan
Program Manager
January 1981

Section One
BACKGROUND

Sea Grant is a branch of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. The National Sea Grant Program is concerned with the development and wise use of the ocean's resources. It was established in 1966 to accelerate research, education, and advisory services in marine resources to encourage the conservation, proper management, and social and economic utilization of marine resources.

During its first twelve years, the California Sea Grant College Program has concentrated primarily on research, professional education and training, and advisory services. The program now seeks to expand its involvement in public education. As part of this new emphasis, Sea Grant funded a two-part project administered through the UC Santa Cruz science writing internship program: (1) a survey and report of postsecondary institutions and their involvement in marine education; and (2) a survey and report of marine education in California elementary and secondary schools, and of contributions made by other private and public institutions, organizations, and individuals. This report is the product of the second portion of this Sea Grant project.

At the outset of the research in January 1979, the following objectives were set by Sea Grant administrators (listed in order of Sea Grant priorities):

1. Compile a comprehensive inventory of marine education activities affecting elementary and secondary students in California public schools, including
   - A. Identification of specific instructors
   - B. Identification of course offerings, course content, and student enrollments
   - C. Identification of instructional materials, including
     - (1) Textbooks
     - (2) Films
     - (3) Supplementary publications
   - D. Identification of other instructional resources, including field trip sites and educational services available through government agencies, aquaria, museums, public interest groups, and others.
2. Compile a comprehensive inventory of California marine education activities affecting the general public.

During the course of the research, it became clear that the second objective was subsumed to a great extent under item D of the first objective, since virtually all sources of public marine education also serve elementary or secondary school populations. Therefore, this report does not include a separate section for the second objective.

The product envisioned at the outset of the study was a report of marine education activities in California, exclusive of postsecondary curricula and research. In June 1979, an additional major objective was set for this project, namely, to assess marine education needs in California elementary and secondary public schools.

This needs assessment objective is met in two ways: first, by summarizing the comments of marine educators asked to recommend ways to improve marine education in California; and second, by reporting data indicating the degree to which marine education is provided in California public schools through courses, textbooks, films, field trips, and use of resources. This data provides a basis for professional educators to establish more precisely the marine education needs of the state.

Section Two
RESEARCH STRATEGIES

The research strategy employed from the outset of the project was to collect information from centralized sources, resorting to local sources only as necessary. Conversations with responsible officials in the State Department of Education indicated that there was no statewide compilation of information specifically concerning marine education, thus forcing data reconnaissance to at least a regional level.

A survey of a representative sample of county environmental education coordinators and regional science education specialists was also of only marginal value. Extremely low response to questionnaires at this level soon indicated that phone contact was a far more productive means of identifying active marine educators.

Subsequent conversations at the school district level were more useful, but far from comprehensive. It was often necessary to get in touch with individual schools to obtain the names of marine education instructors. Hence, production of a comprehensive inventory would require contact with primary sources (antithetical to the initial research strategy). Unfor-

tunately, time and budget constraints precluded this exhaustive personal contact; thus the objective of comprehensive coverage could not be fully met.

Because of an almost total lack of published information identifying marine education activities and educators, the use of key informants and networking of sources was critical to the research. This necessitated endless hours of phone conversations to track down knowledgeable individuals. On-site visits to the principal metropolitan coastal regions proved extremely productive, but transportation difficulties and support costs precluded statewide visits. Therefore, surveys of other geographic areas were completed by phone from UC Santa Cruz.

Specific research strategies for each inventory item are discussed below.

I. Identification of specific instructors

The three distinct levels of educational organization--elementary, intermediate/junior high, and high school--required three different approaches.

A. At the high school level, school districts approving marine education texts were identified from a 1977 State Department of Education questionnaire requesting all school districts to submit a list of textbooks approved for use for grades seven through twelve. Not all districts returned the questionnaire, so the findings are not comprehensive. Responding districts were telephoned to obtain the names of individual instructors. In many cases, calls to the individual high schools were necessary.

B. At the junior high[1] level, instructors were identified through a questionnaire mailed to the principals of all 900 public intermediate and junior high schools in the state. Additional information was gathered in personal phone conversations.

C. Because of the large number of public elementary schools and the highly variable way they cover marine topics, instructors were identified only through questionnaires sent to a stratified random sample of 100 elementary school principals, supplemented by information gathered by telephone.

II. Identification of course offerings, course content, and student enrollments

Again, different data collection techniques were used for the elementary, junior high, and high school levels.

A. The 148 high school instructors identified as described above were sent detailed questionnaires, including requests for enrollment figures, course content, etc. This investigation did not include coverage of marine topics in courses other than marine science, such as general biology, earth science, history, etc.

B. Data regarding junior high school courses and total school enrollments were obtained through the questionnaire sent to all intermediate and junior high school principals in the state.

C. Since specific courses in marine topics are rarely taught in elementary schools, curricular information at this level was gathered primarily through a textbook review, film survey, and data requested from marine education resources, as discussed in the following sections.

III. Identification of instructional materials

A. Textbooks

1. High school textbooks were identified in two ways: first, through a review of responses to the State Department of Education textbook questionnaire discussed above; and second, through the questionnaire sent to high school marine science instructors.

2. Textbooks for kindergarten through eighth grades were identified through a State Department of Education publication entitled "Instructional Materials Selection Guide--Science," which lists all state-approved science textbooks for those grades.[2] Each K-8 science textbook was reviewed for quantity of information devoted to marine topics. Time and resource constraints precluded identification and review of textbooks in nonscience subjects.

[1]For purposes of this report the term "junior high" indicates intermediate and junior high levels, except with respect to textbooks.

[2]State approval is not required for high school textbooks.

B. Films

A list of marine-related films was compiled from the film catalogs at the regional instructional materials centers in Sacramento and Hayward. The list was then sent to the 31 California regional instructional materials centers with a questionnaire requesting data on film availability and frequency of use. The centers were also asked to identify additional marine-related films included in their inventory but not on the list. The subject matter covered in the films was determined from a brief film description or from key words in the film title when there was no description.

C. Supplementary publications

The questionnaire sent to high school marine science instructors requested identification and rating of supplementary publications used in their courses. Bibliographies containing lists of supplementary materials were also collected.

IV. Identification of marine education resources

A. Field trip sites were identified through the questionnaires distributed at the high school and junior high levels.

B. Marine education services

A variety of methods was employed to identify marine education services. Numerous environmental resources directories, phone books, educational newsletters, mailing lists, etc., were reviewed for names and addresses. In addition, the junior high and high school questionnaires requested identification of local resources. Furthermore, all phone conversations with educators, administrators, and other individuals included a request for identification of individuals and organizations involved in marine education.

Supplementary note: After this study was completed Sea Grant arranged for the inclusion of a brief marine education questionnaire in the annual State Department of Education's Environmental Education Week mailing to all California public schools. The questionnaire asked if marine topics are included in any classes and if marine-related field trips are taken. It further requested identification of instructors who cover marine topics and data regarding the number of students who take marine-related field trips at each grade level (see Appendix B).

Section Three
FINDINGS

Organization of the results of the study is patterned after the previous sections on objectives and research strategies.

I. Identification of specific instructors

A. High school

Of the 154 high school instructors of marine science courses identified, 88 returned questionnaires, for a response rate of 57 percent.[3] Responses to the subsequent questionnaire distributed with the State Department of Education mailing generated 7 more names of high school marine science instructors. Sea Grant maintains a roster of the names and addresses of all identified high school marine science instructors. To determine the degree to which these instructors constitute all high school marine science educators, selected data from the questionnaire were compared to similar data from the 1977-78 October Report of the State Department of Education. The comparison showed that student enrollments in the courses of 82 instructors accounted for at least 52 percent of the statewide enrollment in oceanography classes as set forth in the October Report data.[4] Hence, 158 instructors would constitute 100 percent, so the 154 instructors surveyed conceivably could represent as much as 97 percent of all high school marine science instructors in the state.

In addition, the October Report data indicate that 19 percent of the districts offer oceanography. Assuming a constant ratio of schools to districts, approximately 154 of the 811 high schools in the state offer oceanography courses. Of those schools,

[3] Six of the 88 responding instructors indicated their courses had been discontinued due to the impact of Proposition 13.

[4] If the October Report course classifications did not include marine biology under oceanography, the data would represent 25 percent of the state's oceanography course enrollments.

124 (81 percent) were represented by the instructors to whom questionnaires were sent.

Table 1 shows a geographic distribution of the 82 high school instructors who returned the questionnaire and were teaching marine science. Assuming a constant student/faculty ratio statewide, the validity of the survey findings is further supported by data in this table that show a strong correlation between percentage of respondents by county and percentage of total high school students by county.

Table 1

Geographic Distribution of High School Marine Science Instructors

County	Instructors* Surveyed	# Responding	% of Total Respondents	% of CA. Public H.S. Students in County**
Southern California				
Los Angeles	33	22	26.8	28.6
San Diego	18	13	15.9	6.8
Orange	25	12	14.6	9.5
Santa Barbara	11	7	8.5	1.3
San Luis Obispo	3	3	3.7	.6
Ventura	3	3	3.7	2.6
San Bernardino	4	2	2.4	3.7
Others	1	0	0	5.4
Subtotal	98	62	75.6	58.5
Northern California				
Contra Costa	8	6	7.3	3.5
Alameda	7	3	3.7	4.8
Santa Clara	7	3	3.7	6.7
Marin	3	2	2.4	1.0
San Francisco	5	2	2.4	1.4
Monterey	3	1	1.2	1.0
San Benito	2	1	1.2	.1
Santa Cruz	3	1	1.2	.7
Amador	1	1	1.2	.1
Others	5	0	0	22.2
Subtotal	44	20	24.3	41.5
TOTALS	142	82	100.0	100.0

*Not included are instructors who were surveyed but whose responses indicated no marine science course currently being taught.

**For this and all subsequent tables, figures for county public school student populations were obtained from the *1978 California Public School Directory*, and figures for statewide public school populations were obtained from the California State Department of Education publication entitled "Fingertip Facts on Education in California."

Table 2

High School Instructors' Awareness of Other Marine Educators

# of Other Marine Educators Known	% of High School Instructors Reporting Column One Number
0	48
1	28
2	17
3	5
4	2

The findings for southern California are considerably more representative, given that only 5.4 percent of the high school student population in that part of the state was in counties unrepresented by survey respondents. In northern California, however, 22.2 percent of the high school student population was in unrepresented counties.

These data also show that 76 percent of the marine science instructors are in southern California, whereas only 58 percent of the high school students are in that part of the state. There are two possible explanations of this phenomenon. First, the climate, accessibility to the coast, difference in geography, and higher per capita incomes in southern California are more favorable to specialty courses in marine science. An alternative explanation is that southern California had a higher response rate (63 percent) than northern California (45 percent), and if the response rates were balanced, the apparent differences might be minimized.

Another important finding concerning high school marine science instructors is illustrated in the data contained in table 2. These data indicate that most high school marine science instructors are unaware of other marine educators, with only 24 percent able to identify more than one other instructor in the field.

B. Junior high school

All 900 California intermediate and junior high school principals were sent marine education questionnaires. Responses were

received from 165 schools, a response rate of 18 percent. Hence the findings are representative of the entire state.

Instructors were identified by 85 percent of the responding schools. Of the 290 instructors identified, 20 percent (58) teach marine science courses, and 80 percent teach other courses that include marine topics. Thirty-six additional junior high marine science instructors were identified through other survey techniques, and one more through the questionnaire distributed through the State Department of Education's Environmental Education Week mailing. Sea Grant maintains a roster of the names and addresses of all instructors identified.

C. Elementary school

Given that questionnaire responses constitute only 0.5 percent of all public elementary schools in the state, representative numbers of instructors involved in elementary marine education cannot be determined. However, 18 of the 25 responding principals identified 41 individual instructors whose classes include study of the marine environment. Through phone conversations and other correspondence, another 22 elementary school teachers were identified as actively involved in marine education. The questionnaire distributed with the Environmental Education Week mailing generated another 166 names. Sea Grant maintains a roster of all the elementary school instructors identified.

II. Identification of courses and enrollments

According to the October Report data, the number of districts reporting oceanography courses increased by 25 percent (from 71 to 89 districts) between the 1976-77 and 1977-78 academic years. However, the number of students enrolled in oceanography courses slightly decreased (less than 1 percent) during that time. According to the most recent information available, students in oceanography courses were roughly 1 percent of the total students enrolled in science courses in California. Statistics also indicate that 19 percent of the school districts offer oceanography classes, and approximately 0.5 percent (9,606) of the students in grades 7 through 12 in California public schools enroll in oceanography courses. To provide some perspective, this number is comparable to enrollments in such subjects as third-year French, dance choreography and production, ancient history, library education, and military science.

Table 3

Geographic Distribution of Student Enrollments in High School Marine Science Courses

County	% of Calif. H.S. Students in County	% of Total Enrollments Reported	# of Students Enrolled	% of County H.S. Students Enrolled
Southern California				
Los Angeles	28.6	22.7	1,143	.3
Orange	9.5	22.2	1,120	9
San Diego	6.8	16.8	848	1.0
Santa Barbara	1.3	7.0	351	2.1
Ventura	2.6	1.8	91	.3
San Bernardino	3.7	1.8	90	.2
San Luis Obispo	.6	1.6	82	1.1
Others	5.4	0	0	0
Subtotal	58.5	73.9	3,725	—0.5
Northern California				
Contra Costa	3.5	9.1	458	1.0
Alameda	4.8	3.9	195	.3
Santa Clara	6.7	3.0	152	.2
Monterey	1.0	2.6	130	1.0
Marin	1.0	2.7	114	.9
San Francisco	1.4	2.2	110	.6
San Benito	.1	1.5	75	4.3
Santa Cruz	.7	.8	40	.4
Amador	.1	.8	40	3.6
Others	22.2	0	0	0
Subtotal	41.5	26.1	1,314	—0.2
TOTALS	100	100	5,039	—0.4

A. High school

Table 3 reports data concerning student enrollments in high school marine science courses by county. Most California counties report marine science courses in numbers proportionate to their percentage of California high school students. However, there were no students reported for several counties with larger populations, i.e., Sacramento, San Mateo, Riverside, Fresno, Kern, and San Joaquin.

Furthermore, the data indicate that approximately 0.5 percent of the high school students in southern California high schools are enrolled in marine science courses, whereas less than half that percentage (0.2 percent) of the northern Cali-

Table 4

High School Marine Science Course Distribution by Course Title

	Oceanography	Marine Biology	Marine Science	Marine Ecology	Other	Totals
Courses	35 (39%)	25 (28%)	18 (20%)	7 (8%)	4 (5%)	89
Enrollments	2393 (47%)	1069 (21%)	1109 (22%)	238 (5%)	206 (4%)	5039
Student contact hours	324,206 (49%)	136,570 (21%)	137,145 (21%)	37,925 (6%)	26,880 (4%)	662,726

fornia high school students are enrolled in such courses.

Table 4 shows the distribution of high school marine science courses according to the four course titles most often reported, namely oceanography, marine biology, marine science, and marine ecology. Ninety percent of the enrollments are accounted for by the first three titles, with oceanography courses constituting nearly half of the total enrollments.

Although the course titles suggest differences in content, the topical coverage of these courses, shown in table 5, does not indicate any major differences. In fact, a careful examination of this table indicates that there is striking similarity in the composition of these courses, with one

Table 5

Topical Coverage of High School Marine Science Courses

	% of Courses Reporting Coverage					Average % Reported				
Marine Topic	0	MB	MS	ME	Total	0	MB	MS	ME	Total
Animals	93	100	100	100	97	18	33	24	26	24
Chemistry	100	88	93	100	95	8	6	8	5	7
Mammals	89	100	100	80	94	7	8	9	7	8
Plants	89	94	93	100	92	7	9	9	9	8
Geology	100	75	86	100	90	11	5	11	4	9
Water dynamics	96	75	79	100	87	12	4	8	5	8
Natural history	75	94	86	80	83	7	12	7	13	9
Controversial issues	82	81	71	80	79	5	4	3	6	5
Lab techniques	75	88	64	100	78	5	7	5	6	5
Resources	86	69	64	80	76	6	2	5	3	5
Research	79	81	50	60	71	4	4	2	3	4
Careers	71	75	57	80	70	3	1	2	4	2
Mariculture	64	75	50	80	65	2	2	1	3	2
Maritime history	57	56	29	20	48	2	1	1	1	1
Other	28	31	36	14	27	5	1	3	4	4

O = Oceanography, MB = Marine Biology,
MS = Marine Science, ME = Marine Ecology

exception: marine biology courses appear to devote significantly more time to the study of marine life, whereas oceanography courses concentrate more on geology and water dynamics.

Even so, topical coverage in all high school marine science courses is dominated by life science subjects. Coverage of animals, plants, and natural history accounts for nearly 50 percent of the course content, whereas physical sciences (chemistry, geology, water dynamics) compose 24 percent.

As shown in table 6, instructors reported courses of three different lengths, namely less than ten weeks, one semester, and two semesters. Two interesting observations can be made from these data. First, there are few high school courses of less than ten weeks' duration. Second, while more instructors teach two-semester courses, there are more students enrolled in one-semester courses.

Table 6

Distribution of High School Marine Science Courses by Course Duration

	<10 weeks	One Semester	Two Semesters	Totals
Courses	5 (6%)	36 (40%)	48 (54%)	89
Enrollments	194 (4%)	2,563 (51%)	2,282 (45%)	5039

Table 7

Geographic Distribution of Junior High School Marine Science Instruction

	% of Total Calif. Public Jr. High Students in Area	% of Total Responding Schools' Enrollment in Area	% of Students in Responding Schools	Respondents' Enrollment in Schools Offering Marine Science Course			Respondents' Enrollment in Schools Offering Marine Coverage in Other Courses			Respondents' Enrollment in Schools Offering No Coverage of Marine Topics		
				# of Students	% of Total Respondents in Category	% of Area's Respondents in Category	# of Students	% of Total Respondents in Category	% of Area's Respondents in Category	# of Students	% of Total Respondents in Category	% of Area's Respondents in Category
Southern California Counties												
Los Angeles	32.21	32.30	16	17,314	40.2	38	24,179	29	54	3,697	26	8
San Diego	7.92	11.90	24	4,919	11.4	30	11,727	14	70	-	-	-
Orange	8.73	10.44	19	4,831	11.2	33	9,776	12	67	-	-	-
San Bernardino	3.89	4.37	18	1,100	2.6	18	5,008	6	82	-	-	-
Riverside	2.92	4.28	24	640	1.5	11	3,334	4	56	2,016	14	33
Santa Barbara	1.21	2.41	32	3,379	7.9	100	-	-	-	-	-	-
Ventura	2.56	2.31	15	1,400	3.3	43	1,835	2	57	-	-	-
San Luis Obispo	.49	.32	10	-	-	-	450	.5	100	-	-	-
Total for So. Calif.	59.93	68.33	18	33,583	78.1	35	56,309	67.5	59	5,713	40	6
Northern California Counties												
Alameda	4.55	4.67	17	1,415	3.3	21	4,621	6	71	500	4	8
Santa Clara	5.67	6.40	18	2,950	6.9	33	2,512	3	28	3,487	25	39
Sacramento	3.52	3.17	14	1,000	2.3	23	3,434	4	77	-	-	-
San Joaquin	1.12	2.55	37	-	-	-	3,571	4	100	-	-	-
Stanislaus	1.07	2.07	31	-	-	-	2,902	4	100	-	-	-
Sonoma	1.23	1.91	25	-	-	-	2,365	3	88	310	2	12
Solano	1.07	1.82	27	-	-	-	2,551	3	100	-	-	-
San Mateo	2.24	1.48	11	600	1.4	29	420	.5	20	1,050	7	51
Santa Cruz	.58	1.40	39	896	2.1	46	1,065	1	54	-	-	-
Contra Costa	2.77	1.24	7	857	2.0	49	875	1	51	-	-	-
Napa	.50	.69	22	-	-	-	-	-	-	960	7	100
Butte	.41	.66	26	-	-	-	365	.5	40	556	4	60
Mendocino	.24	.66	45	920	2.1	100	-	-	-	-	-	-
Yolo	.38	.54	23	-	-	-	756	1	100	-	-	-
Monterey	1.10	.44	6	-	-	-	-	-	-	612	4	100
Marin	.97	.43	7	605	1.4	100	-	-	-	-	-	-

Tulare	1.06	.43	6	230	.5	38	369	.5	62	-	-	-	-	-	-	-	-	-	-	-
Nevada	.16	.25	26	-	-	-	350	.5	100	-	-	-	-	-	-	-	-	-	-	-
Inyo	.06	.23	59	-	-	-	-	-	-	322		2							100	
Merced	.67	.22	5	-	-	-	-	-	-	303		2							100	
El Dorado	.34	.19	9	-	-	-	-	-	-	265		2							100	
Tehema	.17	.09	9	-	-	-	130	<.5	100	-	-	-	-	-	-	-	-	-	-	-
Plumas	.08	.09	18	-	-	-	120	<.5	100	-	-	-	-	-	-	-	-	-	-	-
Modoc	.04	.05	23	-	-	-	75	<.5	100	-	-	-	-	-	-	-	-	-	-	-
Total for No. Calif.	30.00	31.67	17	9,473	21.9	21	26,481	32.5	60	8,365		60							19	
Total for State	89.93	100	17.5%	43,056	100	31	82,790	100	59	14,078		100							10	

B. Junior high school

Since 18 percent of all California junior high students were represented by responding schools, the data is representative of the entire state. Of the 165 responding intermediate and junior high schools, 31 percent offered specific courses in the marine sciences, 59 percent covered marine topics in other courses, and 10 percent indicated no coverage at all (see table 7).

This table reflects a pattern similar to that of the high school data, in that most California counties are represented in numbers proportionate to their percentage of California intermediate and junior high school students (compare the first two columns). Enrollments in marine science courses and courses covering marine topics also show a nearly constant ratio to total student population. However, in data concerning enrollments in schools with no coverage of marine topics, this pattern does not hold in several cases. Such discrepancies are not surprising in inland counties, and this is reflected in the data. Yet several northern California coastal counties (Monterey, Napa, San Mateo, and Santa Clara) also show a disproportionate share of schools without marine coverage. For example, Santa Clara County, with 5.7 percent of the total California junior high school student population, makes up 25 percent of the sample population of schools with no coverage of marine topics.

Again, southern California had a higher response rate, with total school enrollments for responding schools constituting 17.6 percent of all southern California junior high students. In northern California, only 13.3 percent of the junior high students were enrolled in responding schools.

Table 8

Junior High Courses with Marine Science Coverage

Course Title	# of Courses	% of Total Courses Named
Science or General Science	124	44.6
Oceanography	34	12.2
Life Science	26	9.4
Biology	14	5.0
Earth Science	12	4.3
Marine Science	10	3.6
Marine Biology	8	2.9
Environmental Studies	6	2.2
Ecology	5	1.8
Physical Science	5	1.8
Marine Ecology	3	1.1
Social Science	3	1.1
Language Arts	2	.7
Miscellaneous	26	9.4
Total Courses	278	100.1

A total of 178 junior high courses were identified, and their distribution by course title is shown in table 8. Nearly half the courses covering marine topics were reported as science or general science courses. Four marine science course titles (oceanography, marine biology, marine science, and marine ecology) constituted 20 percent of the courses identified. Only 5 of the 278 courses identified (~2 percent) were outside the scope of the natural sciences--three courses in social sciences and two in language arts.

Table 9

Junior High Marine Science Course Distribution by Course Title

	Oceanography	Marine Biology	Marine Science	Marine Ecology	Total
# of courses	34	8	10	3	55
% of marine science courses	62	15	18	5	100
% of all J H courses with marine science coverage	12	3	4	1	20

As shown in table 9, distribution of the four most frequently named marine science courses is very similar to the high school level (table 4), although oceanography courses constitute a significantly higher percentage at the junior high level (62 percent compared to 39 percent).

Table 10

Content of Junior High Courses Named in Table 8

% of Course Content Devoted to Marine Topics	# of Courses Reporting Column One Percentage	% of Total Courses
0 - 4%	9	3.2
5 - 9%	64	23.0
10 - 14%	64	23.0
15 - 19%	33	11.9
20 - 24%	20	7.2
25 - 29%	10	3.6
30 - 39%	17	6.1
40 - 49%	0	0
50 - 59%	13	4.7
60 - 69%	4	1.4
70 - 79%	3	1.1
80 - 89%	0	0
90 - 99%	3	1.1
100%	38	13.7
TOTALS	278	100.0

Since it was anticipated that many courses identified would not be specific marine education courses, principals were asked to estimate the percentage of course time devoted to marine topics. Unfortunately, a number of respondents provided data that was obviously erroneous. For example, one respondent identified an oceanography course but indicated only 5 percent of that course was devoted to study of the marine environment. This problem notwithstanding, table 10 describes the percentage of course content devoted to marine topics. According to these data, over two-thirds of the courses devoted less than 25 percent of their time to study of the marine environment.

C. Elementary school

Given the small sample and low response rate, no representative data were reported concerning coverage of marine topics at the elementary level. However, of the 25 principals returning questionnaires, 19 (76 percent) indicated that marine topics were included in at least one class. Sixteen (64 percent) of the responding schools indicated at least one marine-related field trip, for a cumulative total of 1,907 students taking such trips. That figure represents 17 percent of the total student enrollments for all responding elementary schools. For the subsequent Sea Grant questionnaire distributed with the State Department of Education's Environmental Education Week mailing, 70 of the 92 responding elementary schools (76 percent) indicated coverage of marine topics, and 70 percent reported at least one marine-related field trip. A total of 4,797 students from those schools took such field trips (see Appendix B).

Because of the difficulty of obtaining specific information about elementary school marine education, it is helpful to review results from other portions of this study discussed in detail later in this report. The textbook review indicated that elementary school science textbooks devote only 3 percent of their pages to marine topics. Of the marine related films identified, 70 percent were appropriate for grades one through six, but only 9 of the 25 most often used films (36 percent) were elementary level. Other sources of marine education services (museums and aquaria, county schools office programs, public interest groups, etc.) frequently benefit elementary school students. Unfortunately, participant information was rarely broken down by grade level. However, data available from 34 of the more active organizations providing marine education services show that over a million students in kindergarten through twelfth grade (approximately 20 percent of all K-12 students in California schools, public and private) benefit from their efforts. The portion of this number that is elementary school students is unknown, but it is most likely at least half. Clearly, marine education services provided by sources other than classroom teachers play a significant role at the elementary school level.

III. Identification of instructional materials

A. Textbooks

(1) High school

A review of the 1977 State Department of Education questionnaire concerning junior high and high school textbooks yielded the titles of 65 different marine science textbooks. In addition, the questionnaire sent to high school marine science instructors requested them to identify textbooks and supplementary publications they used. Eighty-three different materials were listed, 48 of which corresponded to those identified in the state questionnaire. Hence 118 different titles were identified altogether. Further, 11 instructors indicated that they prepared and used their own instructional materials.

Of the 89 high school courses, 51 (57 percent) include the use of at least one textbook. A preliminary analysis indicated that 18 (22 percent) of the instructional materials listed were marine science textbooks (11 oceanography, 5 marine biology, 1 combining both, and 1 marine botany); 7 (8 percent) were textbooks for another subject area (earth science, biology, etc.); and the balance (70 percent) were supplementary materials.

Table 11

High School
Marine Science Textbooks

Title and Author	Excel.	Good	Fair	Poor	No Rating	Total
Oceanography: An Introduction; by Ingmanson & Wallace (1973)	3	4	2	0	3	12
The World Ocean: Introduction to Oceanography; by Anikouchine & Steinberg (1973)	3	4	3	0	0	10
Natural History of Marine Animals; by MacGinitie and MacGinitie (1968)	3	3	3	0	1	10
Oceanography -- A View of the Earth; by Gross (1977)	2	5	2	0	0	9
Oceanography and Our Future; by Oxenhorn	0	3	3	1	1	8
Oceanography -- A Study of Inner Space; by Yasso (1965)	0	4	0	4	0	8
Introduction to Oceanography; by Weisburg & Perish (1974)	0	2	1	1	1	5
Introduction to the Biology of Marine Life; by Sumich (1976)	2	2	1	0	0	5
Oceanography -- An Introduction to the Marine Environment; by Weyl (1970)	2	3	0	0	0	5

Table 11 lists the nine most frequently reported high school marine science textbooks, together with the instructors' ratings of their quality.

Table 12

Instructor's Ratings of Marine Science Textbooks and Supplementary Publications

	Excel.	Good	Fair	Poor	No Rating	Total
# of ratings	88	72	35	9	35	239
% of total responses	37	30	14.5	4	14.5	100

The data in table 12 shows the rating distribution for all textbooks and supplementary publications identified by high school marine science instructors. Even though 67 percent of the materials were rated good or excellent, the most commonly cited recommendation of these same instructors was to provide a quality marine science textbook for the high school level. In addition, the third most often cited recommendation was to develop, improve, and distribute quality instructional materials.

Table 13

Summary of Science Textbook Data for Kindergarten through Eighth Grade

Grade Level	Number of Texts	Number Ordered*	% of Total Orders	Total Pages	Pages On Marine Topics**	% of Total on Marine Topics
K-3	21	96,550	19.37	3,580	68	1.90
4-6	24	192,901	38.71	6,315	205	3.25
K-6 Subtotal	45	289,451	58.08	9,895	273	2.76
7-8	56	208,903	41.92	19,812	816	4.12
TOTALS	101	498,354	100	29,707	1,089	3.67

*Orders placed through California State Department of Education during 1978-79 school year.

**Figures are generous, as partial pages were counted as whole.

(2) Junior high school

The 56 state-approved science textbooks for use in public junior high schools (grades seven and eight only) contained a total of 816 pages devoted to marine topics (see table 13). This coverage amounted to 4.12 percent of the total pages in these texts. As indicated in the table, the lower the grade level, the lower the percentage of pages devoted to marine topics, with junior high science texts devoting twice as much as primary science texts.

Table 14 lists the six most frequently ordered junior high science textbooks. These texts constituted nearly 41 percent of all junior high science textbooks ordered for use in the 1979-80 academic year. Marine topics constituted 4.44 percent of the content of these books.

Table 14

Most Frequently Ordered Junior High Science Textbooks

Book Title	% of Total J.H. Orders	Total Pages	Pages on Marine Topics	% of Total Pages on Marine Topics
1. Concepts in Science; Life: A Biological Science	9.33	495	48	9.70
2. Focus on Life Science	7.94	498	5	1.00
3. Concepts in Science; Matter: An Earth Science	6.70	431	35	8.12
4. Principles of Science--One	5.69	519	18	3.47
5. Principles of Science--Two	5.69	508	21	4.13
6. Life Science--A Problem Solving Approach	5.36	408	0	0
TOTALS	40.71	2,859	127	4.44

Table 15

Junior High Science Texts with Most Coverage of Marine Topics

Book Title	% of Total J.H. Orders	Total Pages	Pages on Marine Topics	% of Total Pages on Marine Topics
1. Exploring Earth Science	.48	491	63	12.83
2. Focus on Earth Science	4.88	522	52	9.96
3. Matter: Its Forms and Changes	2.82	549	52	9.47
4. Earth Science--The World We Live In	.36	667	49	7.35
5. Concepts in Science; Life: A Biological Science	9.33	495	48	9.70
6. The Earth: Its Living Things	1.39	548	47	8.60
TOTALS	19.26	3,272	311	9.50

Table 15 lists the six junior high science textbooks with the highest number of pages devoted to marine topics. These books constituted only 19.26 percent of all junior high science textbooks ordered, yet they contained two and one-half times as many pages on marine topics.

Table 16

Most Frequently Ordered Elementary Science Textbooks

Book Title	Grade Level	% of Total Elem. Orders	Total Pages	Pages on Marine Topics	% of Total Pages on Marine Topics
1. Concepts in Science; Newton Edition (Brown)	6	8.53	367	1	.27
2. Science: Understanding Your Environment (5)	5	6.56	344	29	8.43
3. Science: Understanding Your Environment (6)	6	6.56	380	6	1.58
4. Concepts in Science; Newton Edition (Purple)	5	6.45	355	7	1.97
5. Science: Understanding Your Environment (4)	4	5.87	279	10	3.58
6. Concepts in Science; Newton Edition (Orange)	4	5.15	327	14	4.28
TOTALS		39.13	2,052	67	3.27

Table 17

Elementary Science Textbooks with Most Marine Education Material

Book Title	Grade Level	% of Total Elem. Orders	Total Pages	Pages on Marine Topics	% of Total Pages on Marine Topics
1. Investigating in Science -- Generating Ideas	6	1.42	342	51	14.91
2. Self-Paced Investigations for Elementary Science -- Oceans/Space	5-6	5.18	95	48	50.52
3. Science: Understanding Your Environment (5)	5	6.56	344	29	8.43
4. Concepts in Science; Newton Edition (Orange)	4	5.15	327	14	4.28
5. Concepts in Science; Newton Edition (Green)	4	3.52	306	14	4.58
6. Investigating in Science -- Exploring Ideas	4	1.00	295	12	4.07
TOTALS		22.83	1,619	168	10.38

Table 17 lists the six elementary science textbooks with the highest number of pages devoted to marine topics. These books constituted only 23 percent of all elementary science textbooks ordered, yet like junior high texts, they contained two and one-half times as many pages on marine topics.

(3) Elementary school

The 45 state-approved science textbooks for use in California public elementary schools contained a total of 273 pages devoted to marine topics (see table 13). This coverage amounted to 2.76 percent of the total pages in these textbooks. Table 16 lists the six most frequently ordered elementary science textbooks. These books comprised nearly 40 percent of all elementary science textbooks ordered for use in the 1979-80 academic year. Marine topics constituted 3.27 percent of the content of these books.

B. Films

Because films are appropriate for a variety of grade levels, this section is not subdivided for high school, junior high school, and elementary school.

The 17 instructional materials centers that responded to the film questionnaire (a 59 percent response rate) identified 170 films beyond the 120 listed on the questionnaire. Unfortunately, instructional materials centers in four of the major coastal counties (Los Angeles, Orange, San Diego, and San Francisco) were [illegible] among the respondents.

Table 18

Most Frequently Borrowed Marine Science Films

Film Title	Year	Grades K-3	Grades 4-6	Grades 7-9	Grades 10-12	Adult
1. Sea Otter	1971	-	-	x	x	x
2. Sharks	1976	x	x	x	x	x
3. Seashore: Pacific Coast	1968	x	x	-	-	-
4. Tripping with Terwilliger--Bay Tidelands	1973	x	x	-	-	-
5. Seal Island	1949	-	x	x	x	-
6. Life in the Ocean	1955	-	x	x	-	-
7. Coral Jungle	1969	-	x	x	x	-
8. Secrets of the Underwater World	1961	-	x	x	-	-
9. Beach and Sea Animals	1957	x	x	-	-	-
10. Exploring the Ocean	1972	-	x	-	-	-
11. Tripping with Terwilliger--Redwood Forests, Stream, Ocean Beach, Butterfly Trees	1973	x	x	-	-	-
12. Beach, A River of Sand	1966	x	x	x	x	-
13. Ocean: A First Film	1968	x	x	-	-	-
14. Sea Adventures of Sandy the Snail	1957	x	-	-	-	-
15. Life Between Tides	1963	-	x	x	x	-
16. Sea	1962	-	-	x	x	-
17. Mysteries of the Deep	1959	-	x	x	x	-
18. Green Sea Turtle	1969	-	x	x	x	-
19. Challenge of the Oceans	1962	-	-	x	x	-
20. Japan Harvests the Sea	1961	-	x	x	-	-
21. Coco at the Seashore	1956	x	-	-	-	-
22. We Explore Ocean Life	1962	-	x	x	-	-
23. Winter Sea Ice Camp	1969	-	x	x	x	x
24. What's Under the Ocean	1960	-	x	x	-	-
25. Oceanography: Science of the Sea	1962	-	x	x	x	-
TOTALS		9	20	17	12	3

Table 18 contains a compilation of the 25 films most frequently borrowed from the responding centers, together with the date and grade-level applicability of the film. Only 36 percent of the films were suitable for primary grades (K-3), although 82 percent were recommended for intermediate students (4-6). In spite of the increased attention to marine education at the high school level, only 48 percent of the films were considered appropriate for this audience.

Table 19

Film Grade Levels

Grade Level	% of Total Films	% of Most Used Films
K-3	15	36
4-6	55	80
7-9	72	68
10-12	65	48
Adult	29	12

Table 19 summarizes grade-level recommendations for 52 percent of the entire film inventory, including most frequently borrowed films. These data also show that a disproportionately low percentage is considered appropriate for primary grades.

Table 20 summarizes the age of 72 percent of the films identified, and includes a separate summary for the 25 most frequently used films. These data indicate that although 39 percent of the films were produced after 1969, only 20 percent of the most frequently used films were from that time period.

Table 20

Film Dates

Year	% of Total Films	% of Most Used Films
1944-1949	3	4
1950-1954	6	0
1955-1959	9	20
1960-1964	18	32
1965-1969	25	24
1970-1974	23	16
1975-1979	16	4

Table 21

Topical Coverage of Films

Subject Covered	% of Total Films
Marine animals	34
Marine mammals	10
Marine environments (generally or specific locations)	8
Fishing	8
Marine plants	6
Water dynamics	5
Marine geology	5
Marine resources	5
Marine ecology	5
Marine research	5
Coastal wetlands	4
Careers	3
Marine issues	3
Marine pollution	3
Coral reefs	3
Maritime history	3
Marine art and literature	2
Marine chemistry	1

Table 21 lists categories of the subject matter covered in the films identified, and indicates the percentage of films germane to each subject. Nearly half of the films include coverage of marine animals.

Table 22

Marine Education Sources

Source Type	Northern California			Southern California			State	
	Number	% of Regional Resources	% of State Source Type	Number	% of Regional Resources	% of State Source Type	Number	% of State Resources
Schools	17	12.5	50	17	10.5	50	34	11.4
Government	38	27.9	44.2	48	29.6	55.8	26	28.9
Public interest groups	33	24.3	45.8	39	24.1	54.2	72	24.2
Museums and aquaria	7	5.1	43.8	9	5.6	56.2	16	5.4
Other	41	30.1	45.6	49	30.2	54.4	90	30.2
Totals	136	100	45.6	162	100.0	54.4	298	100.1

IV. Identification of marine education resources

A general discussion of the types of services and organizations involved in marine education precedes the specific findings for high school and junior high school resources. The highly diverse nature of these resources made a comprehensive inventory very difficult. The findings are by no means exhaustive.

Five major categories of organizations provide marine education services: schools (including colleges and universities with some involvement with elementary or secondary schools), government agencies (including state parks), museums and aquaria, public interest groups, and a miscellaneous category of private enterprises, individuals, etc. Table 22 classifies 298 identified sources into these five categories. Government agencies and public interest groups constituted over 50 percent of the marine education sources, whereas schools, museums, and aquaria constituted slightly over 15 percent. The results of this inventory parallel previous findings; the difference in the sources generally reflects the population distribution, with 54 percent in southern California and 45 percent in northern California.

Six major categories of marine education services are provided by these sources:

1. In-classroom services, including speakers, class aides, and traveling exhibits.
2. Site-specific field trips to (a) a particular outdoor marine environment such as a tidepool or pier, (b) a marine-related facility such as a research laboratory or commercial enterprise, and (c) a public display such as a museum or amusement park. Three types of field trips were identified: instructor-supervised visits, self-guided tours, or source-guided tours.
3. Out-of-classroom programs of formal instruction, including courses, workshops, research activities, and in-residence outdoor education programs.
4. Information services such as responses to public information requests, environmental resource centers, and public meetings.
5. Single special events, such as symposia, fairs, and celebration days.
6. Teacher education, including formal courses, workshops, and symposia.

Table 23

Marine Education Resources by Source Type and Service Type

Source:	Schools	Government	Public Interest	Museums and Aquaria	Other	Region Totals	Total for State #	Total for State %
Service:								
In-class	N.CA	3	13	10	2	3	31	9.0%
	S.CA	5	9	9	6	1	30	8.7%
Subtotal		8	22	19	8	4	61	17.7%
Field trip sites	N.CA	8	16	7	4	8	43	12.5%
	S.CA	4	18	9	8	10	49	14.2%
Subtotal		12	34	16	12	18	92	26.7%
Programs	N.CA	7	0	3	2	29	41	11.9%
	S.CA	6	0	1	4	13	24	7.0%
Subtotal		13	0	4	6	42	65	18.9%
Information services	N.CA	5	15	26	4	5	55	15.9%
	S.CA	6	10	18	6	6	46	13.3%
Subtotal		11	25	44	10	11	101	29.2%
Single event	N.CA	3	0	2	0	0	5	1.5%
	S.CA	2	0	1	3	0	6	1.7%
Subtotal		5	0	3	3	0	11	3.2%
Teacher education	N.CA	2	1	2	0	3	8	2.3%
	S.CA	5	0	0	1	1	7	2.0%
Subtotal		7	1	2	1	4	15	4.3%

Table 23 shows the distribution of these categories of marine education services for 196 (66 percent) of the sources, many of which provide more than one type of service. Field trip sites and information services constitute well over half the services, with formal programs and in-classroom services accounting for another 35 percent.

Table 24

High School Instructor Awareness of Local Marine Education Resources

# Guest Speakers Used by Instructor	% of Instructors Reporting Use	# Other Resources Instructors Aware of	% of Instructors Reporting Awareness*
0	61	0	21
1	20	1	12
2	15	2	22
3	2	3	20
4	1	4	16
5	1	5	1
6	0	6	6
>6	0	>6	2

*Awareness does not necessarily imply use.

A. High Schools

Tables 24 through 27 describe high school marine science instructors' responses to questions about marine education resources. Seventy-nine percent of the instructors were aware of at least one marine education resource, but less than 25 percent were aware of more than three. The most striking finding in these data, however, is the limited use of guest speakers: 61 percent of the instructors indicated they did not invite speakers to their classes. This is particularly surprising since in-classroom services rank first in availability of resources as set forth in table 23.

Table 25 rank orders the types of marine education resources most frequently reported by high school marine science instructors. Museums were by far the most frequently cited resource, even though they were also in the shortest supply. Government offices, schools, and other resources were named an approximately equal number of times, and public interest groups were listed about half as often. High school marine science instructors identified a total of 99 different marine education resources. Since 299 resources were identified through the combination of survey techniques employed in this study, high school marine science instructors reported awareness of only 33 percent of the marine education resources available.

Table 25

Classification of Marine Education Resources Reported by High School Marine Science Instructors

Source Type	Times Reported	% of Resources Reported	% of Statewide Resources Identified in Study
Museum	70	29.1	5.4
Government	51	21.3	28.8
Other	51	21.3	30.2
Schools	49	20.4	11.4
Public interest groups	19	7.9	24.2
Totals	240	100.0	100.0

Table 26 shows field trip destinations for high school marine science classes.[5] These

Table 26

Field Trip Destinations for High School Marine Science Courses

Field Trip Destination	% of Classes
Tidepools	79
Open coast	63
Marine-related exhibit	52
Boat	47
Bay	42
Pier	39
Estuary	36
Laboratory	34
Other	24

[5]Of the 88 marine science courses for which questionnaires were returned, 92 percent indicated at least one marine-related field trip taken.

figures are inconsistent with those reported in table 25, since tidepools and the open coast were visited by a significantly higher percentage of classes than were museums. The discrepancy indicates that the instructors either did not consider the coast a marine education resource in responding to the questionnaire, or that they were aware of museums and aquaria but did not necessarily take their classes there on field trips.

Table 27 rank orders the ten resources most frequently named by high school marine science instructors. Half of these are either museums or aquaria, and only two are located in northern California.

Table 27

Marine Education Resources Most Often Named by High School Marine Science Instructors

Name of Resource	% of Instructors Reporting	% of Total Resources Reported
Cabrillo Beach Museum	19.5	6.7
Scripps Aquarium	17.1	5.8
Steinhart Aquarium	12.2	4.2
Orange Co. Dept. of Education	12.2	4.2
Los Angeles County Museum	9.8	3.3
Sea World	9.8	3.3
Santa Barbara Museum of Natural History	8.5	2.9
UC Santa Barbara	8.5	2.9
Marineland	7.3	2.5
Morro Bay Museum of Natural History	7.3	2.5

B. Junior high schools

Tables 28 through 31 contain similar data for junior high schools. However, data were provided by school principals rather than by marine science instructors, and the principals were asked to identify only those resources used by their school, not all that were available. Consequently, the data for junior high schools are not formally parallel to those for high schools.

According to table 28, the majority (59 percent) of the junior high schools reported using no marine education resources.

Table 28

Junior High School Use of Marine Education Resources

# of Resources Used	% of Jr. High Schools
0	59
1	28
2	11
3	1
4	1

Table 29 shows that at the junior high level, schools (such as county offices of education) were by far the most frequently named resource, with museums and aquaria dropping to third place and government agencies to fourth. Only one principal indicated use of a public interest group.

Of the 165 junior high schools responding to the questionnaire, 58 percent indicated that at least some students went on one marine-related field trip. Not surprisingly, this figure is substantially lower than the 92 percent of high school marine science classes taking field trips. However, data obtained from the Sea Grant questionnaire

Table 29

Classification of Marine Education Resources Used by Junior High Schools

Source Type	Times Reported	% of Resources Reported	% of Statewide Resources Identified
Schools	41	46.1	11.4
Other	27	30.3	30.2
Museums and aquaria	15	16.9	5.4
Government	5	5.6	28.8
Public interest	1	1.1	24.2
Totals	89	100	100

distributed to all schools with the State Department of Education's Environmental Education Week mailing indicate that more marine-related field trips are taken by students in grades five through eight than any other level (see Appendix B).

Table 30 shows field trip destinations for junior high schools. Tidepools were again most popular, with 32 percent of the schools reporting excursions to them. Marine exhibits were close behind, which is consistent with the position of museums and aquaria in the previous table. Approximately 19 percent of the total student population of the reporting junior high schools went on marine-related field trips.

Table 31 lists the five marine education resources most frequently named by junior high schools. These were the only resources named five times or more. Altogether, 47 different resources were named, constituting only 16 percent of the 299 resources identified in this study. Of the 47 resources identified by junior high school principals, 24 were also listed by high school marine science instructors.

Table 30

Junior High School Field Trip Destinations

Field Trip Destination	# of Schools Reporting	% of Sample Schools	# of Students Per Year	% of Total Sample Schools Population
Tidepools	54	32.3	5,391	3.7
Marine exhibit	41	24.6	3,680	2.5
Boat	43	25.8	4,079	2.8
Open coast	41	24.6	3,846	2.7
Marine lab	30	18	2,881	2.0
Bay	25	15.0	2,724	1.9
Estuary	18	10.8	1,554	1.1
Pier	12	7.2	1,141	.8
Other	11	6.6	1,007	.7

Table 31

Marine Education Resources Most Frequently Used by Junior High Schools

Name of Resource	% of Sample Schools	% of Total Resources Reported
Orange Co. Dept. of Education	7.9	14.6
Los Angeles County Schools	4.2	7.9
Marine Ecological Institute	3.6	6.7
Scripps Aquarium	3.6	6.7
Project MER (Alameda/Contra Costa Co.)	3.0	5.6

Section 4
CONCLUSIONS

Given the importance of the ocean and coast to the well-being of California's population, marine education receives minimal attention in the state's public schools. Educational administrators' awareness of marine education activities is highly variable but generally lacking, particularly in larger jurisdictions. There is little coordination of marine education activities at the local, regional, or state level. A number of educators indicated that Proposition 13's adverse effects on funding were disproportionately felt in the area of marine education.

Considering the growing societal implications of scientific research, information transfer from marine researchers to the classroom is sorely lacking.

Several northern California counties (particularly San Mateo, Sacramento, and Santa Clara) are underrepresented in marine education.

High school marine science teachers constitute an extremely small portion of the total number of high school instructors and are generally unaware of others with similar instructional responsibilities, thus severely limiting the exchange of ideas and materials.

High school marine science courses are few. Other subjects provide some coverage of marine topics, but to what extent is unknown.

In spite of differences in course name, texts, etc., and the general lack of coordination in marine education, content of high school marine science courses is strikingly similar.

There is widespread duplication of effort to develop basic marine education materials (bibliographies, literature on marine animals, etc.); these lend themselves to centralized publication and distribution.

There is a scarcity of junior high texts on the marine environment, despite the existence of marine science courses at this level.

In kindergarten through eighth grade, science textbooks devote less than 3 percent of their pages to marine topics.

Given the rapid changes in our knowledge about and relationship with the ocean and coast, use of current films is lacking. Further, the number of marine-related films available for use in primary grades (K-3) is disproportionately low.

Many sources external to schools provide marine education services; however, a number advocate a particular point of view. Schools are generally unaware of marine education resources, particularly guest speakers. For example, only one instructor listed a local fisherman as a guest speaker, yet this is a resource available to almost every coastal school. Likewise, scuba divers were listed by only a few, yet are available to most. State and national coastal parks and reserves were rarely mentioned as marine education resources, yet these public lands make up a substantial portion of our coastlands, and many have interpretive programs.

Identification of Marine Education Needs

A. High schools

All high school marine science instructors indicated there is a need to improve marine education in California, and 74 percent offered suggestions for doing so. A total of 116 recommendations were made. The following is a rank ordered summary of the five recommendations most often stated.

1. Develop a quality textbook for high school marine science courses (listed by 18 instructors).
2. Coordinate marine education activities through resource guides, newsletters, resource centers, etc. (listed by 16 instructors).
3. Improve high school marine education curriculum by developing and distributing current instructional materials and a curriculum guide (listed by 12 instructors).
4. Develop and distribute a high school marine science laboratory guide (listed by 11 instructors).
5. Increase research/field experiences in marine education (listed by 11 instructors).

B. Junior high schools

Of the responding junior high schools, 58 percent offered suggestions for improving California marine education, for a total of 123 recommendations. The following is a rank-ordered summary of the five most frequently made.

1. Provide more research/field experience, particularly through appropriation of funds (listed by 37 schools).
2. Coordinate California marine education through resource guides, newsletters, etc. (listed by 28 schools).
3. Develop and distribute updated instructional materials, particularly a laboratory guide (listed by 13 schools).
4. Develop and distribute a curriculum guide (listed by 12 schools).
5. Provide more money for marine education generally (listed by 12 schools).

APPENDIX A[6]

A brief survey of oceanography course enrollment in the secondary schools of eight states was undertaken as part of this study. As a first step, inquiries were sent to selected members of the Council of State Science Supervisors, Inc. (CSSS). The CSSS members were asked to supply information, for their states, about the kinds and amount of marine-related coursework given in high schools during the 1977-78 academic year. The responses are listed in the accompanying table comparing these data with similar data from a nationwide survey of public secondary school curriculum, for the 1972-73 school year, conducted by the Department of Health, Education and Welfare (DHEW). The DHEW data are based on teacher responses within the oceanography category of secondary school, natural science course offerings (Ostendorf and Horn, 1977).[7] No other categories relevant to this study were surveyed by DHEW.

Most states do not have a continuing mechanism for collecting and reporting detailed course and enrollment data. Therefore, in any future survey it will be necessary to obtain information from local superintendents of schools, science coordinators, or other knowledgeable persons. However, if the present comparison data are representative of the nation, then there were 1.47 times as many students enrolled in oceanography courses in 1977-78 than in 1972-73. Ostendorf (1976)[8] reports that total United States oceanography enrollment in public secondary schools was 46,077 for the 1972-73 school year. Therefore, 1.47 times the 46,077 enrollment in 1972-73 suggests that total United States oceanography course enrollment has risen to 67,733 in 1977-78.

But the enrollment projection may be too low. Knowledgeable professionals in the commercial publishing industry have suggested that oceanography and marine biology enrollment in all secondary schools in the nation for 1977-78 may actually total 150,000.

Regardless of questions about the accuracy of enrollment data discussed above, there is no question that oceanography and marine biology are increasing as secondary school courses or as parts of other courses such as earth science.

Comparison of Department of Health, Education and Welfare (DHEW) Survey of Secondary School Oceanography Courses for the 1972-73 School Year and the National Sea Grant College Program (NSGCP) Survey for the 1977-78 School Year

State	Agency	# of Schools	# of Students
Delaware	DHEW	3	160
	NSGCP	48	995
Florida	DHEW	30	2,670
	NSGCP	129	12,385
Hawaii	DHEW	2	51
	NSGCP	80	2,096
Virginia	DHEW	2	178
	NSGCP	18	852
California	DHEW	*	13,937
	NSGCP	*	8,968
Iowa	DHEW	*	165
	NSGCP	*	45
North Carolina	DHEW	*	393
	NSGCP	*	676
Rhode Island	DHEW	2	175
	NSGCP	40-50	approx. 700
Total	DHEW		17,729
	NSGCP		26,017

*Data are not available

[6]Warren E. Yasso, "Educational Needs of the U.S. Commercial Fishing Industry: A Report to the U.S. Senate by the National Sea Grant College Program, NOAA," (Rockville, Maryland: National Office of Sea Grant, 1980), Appendix F.

[7]L. C. Ostendorf, and P. J. Horn, *Course Offerings, Enrollments, and Curriculum Practices in Public Secondary Schools, 1972-73* (National Center for Educational Statistics, Publication No. 77-153, 1977).

[8]L. Ostendorf, *Summary of Offerings and Enrollments in Public Secondary Schools, 1972-73* (National Center for Educational Statistics, Publication No. 76-150, 1976).

APPENDIX B

The California Sea Grant College Program sent out this brief questionnaire with the Environmental Education Week mailout to all K-12 public schools by the California State Department of Education in 1980.

Questionnaire

Name _____ Address _____

School _____

Dear Educator:

If you return this brief questionnaire, we will send you a Marine Education leaflet, *Identifying Intertidal Plants and Animals*, free.

1. Is study of the marine environment included in the curriculum of any classes taught at this school?
   Yes ____ No ____

2. If yes to question #1, please list the name of the teacher and the grade level of each class.
   _____

3. Do students from this school take field trips to marine-related exhibits or to the marine environment?
   Yes ____ No ____

4. If Yes to #3, how many students go annually from each grade level?
   1: ____ 2: ____ 3: ____ 4: ____ 5: ____ 6: ____ 7: ____ 8: ____ 9: ____ 10: ____ 11: ____ 12: ____

The results of this questionnaire are summarized below.

Number of questionnaires sent: 7,585
Returned: 175 (2.3%)
Number sent to California high schools: 850
Returned: 42
Number sent to California middle/junior high schools: 887
Returned: 29
Number sent to California elementary schools: 5,015
Returned: 88
Number sent to California county or continuing schools: 833
Returned: 0
(12 unspecified)

1. Is the study of the marine environment included in the curriculum of any classes taught at this school?
   Yes: 127 (73%) No: 41 No Response: 7

2. (This was information for compiling a mailing list.)

3. Do students from this school take field trips to marine-related exhibits or to the marine environment?
   Yes: 102 (58%) No: 58 No Response: 15

4. If Yes to #3, how many students go annually from each grade?

Grade	Number of Students
1	133
2	205
3	430
4	768
5	1375
6	1886
7	455
8	1308
9	469
10	239
11	227
12	231

If the responses are considered a random sample of California public schools,[9] then 73 percent of the schools in California include some study of the marine environment in the curriculum, and 58 percent of the schools include field trips to marine-related exhibits or to the marine environment. There appears to be more marine education in grades five through eight than elsewhere in public schools.

[9]First, a reward (free pamphlet) was offered to those returning the questionnaire. Second, 76 percent of those who returned the questionnaire were from schools in coastal counties, and 80 percent of the California population (1970 census) lives in coastal counties.

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